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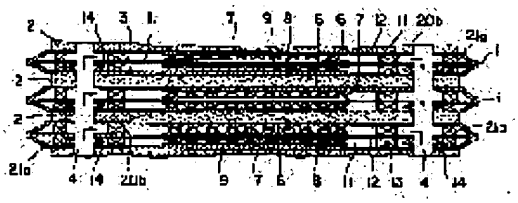
(54) FUEL CELL

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce the unnecessary bending deformation applied to an electrolyte plate by reducing the deformation of edge plates in an edge part and manifold part and by making the edge plates deformed while maintaining a plane.

SOLUTION: This cell is stacked with a positive electrode 6 on one surface of an electrolyte plate 2 and a negative electrode 8 on the other surface, and also stacked with multiple unit cells in which gas channels 7, 9 contacted with each electrode plate respectively to form a gas passage are provided through a separator plate 11. In this case, edge springs 20a, 20b and manifold springs 21a, 21b disposed between the separator plate 11 and edge plates 12, 13 which surface contact with the electrolyte plate 2 are constituted by plate-shaped springs 22 having substantially identical spring characteristics each other.



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CLAIMS

[Claim(s)]
[Claim 1]In a fuel cell which carried out the plural laminates of the unit cell which allocated a gas channel which laminates a negative electrode plate to other fields, and forms a gas way in them respectively in contact with each electrode plate while laminating a positive electrode plate on the whole surface of an electrolyte plate via a separator board, the above-mentioned separator board side and the fuel side -- being certain -- it is -- it being between edge boards which are allocated by periphery of an electromotive part by the side of an oxidizer, and carry out field contact with the above-mentioned electrolyte plate, and, A fuel cell, wherein spring characteristics constitute mutually substantially an edge spring and a manifold spring which are infixed in a circumference of an edge part of a circumference of the above-mentioned electromotive part, and a manifold, respectively with the same tabular spring.
[Claim 2]The fuel cell according to claim 1, wherein a tabular spring is fabricated so that it may have the linear projections which protruded on the field and rectangular directions and an interval of an adjoining projecting surface may become equal.
[Claim 3]The fuel cell according to claim 2, wherein only the angle most desirable in order that each linear projections of a tabular spring may lead gas to an electromotive part inclines to the length direction of a spring.
[Claim 4]The fuel cell according to claim 1 having the punctiform projection of a large number which a tabular spring had regularity, were arranged and protruded on rectangular directions from the field.
[Claim 5]The fuel cell according to claim 1 which drills a hole of a large number arranged by a tabular spring having regularity in a plate, and is characterized by being constituted by equipping so that a spherical member may be projected from both sides of a plate in each hole.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the fuel cell which carried out the plural laminates especially of the unit cell with respect to the fuel cell which transforms chemical energy into electrical energy directly.
[0002]
[Description of the Prior Art]A right and negative electrode plate is allocated so that both sides of an electrolyte plate may be touched, and the unit cell comprises a fuel cell which transforms chemical energy into electrical energy directly by making it make oxidant gas and fuel gas react, respectively. By the way, since it is low, in order to constitute a high-output power generating plant, the electromotive force acquired by this unit cell laminates two or more unit cells in series, constitutes a fuel cell layered product, and has obtained the added output of each unit cell.
[0003]Generally, a separator is formed between the unit cells by which a fuel cell layered product adjoins each other, and the composition which classifies the fuel gas flow route of one unit cell and the oxidant gas passage of the unit cell of another side is taken. Therefore, an oxidant gas passage and a fuel gas flow route will be laminated by turns, and become important [forming a feeding-and-discarding way so that each gas may not leak outside and each gas may not be mixed] in the manifold which supplies each gas.
[0004]Drawing 10 is a perspective view showing the outline composition of the conventional fuel cell layered product, the separator 1 and the electrolyte plate 2 are laminated by turns, and the stack is formed.
The negative electrode plate and positive electrode plate it was made to contact the upper surface [of the electrolyte plate 2] and undersurface side, respectively are allocated by the separator 1 of the upper and lower sides which sandwich the above-mentioned electrolyte plate 2, and the electromotive part 3 is formed in it.
The manifold which consists of the oxidant gas way 4, the fuel gas way 5, etc. is formed in the both ends of a layered product, and each gas is supplied to them to the electromotive part 3.
[0005]Drawing 11 is the sectional view which met the X-X line of drawing 10.
The oxidizer gas channel 7 which has the positive electrode plate 6 and many projections, respectively is

accommodated in the crevice formed in the upper surface side of the electrolyte plate 2 and each separator 1 laminated by turns, The fuel gas channel 9 which has the negative electrode plate 8 and many projections is accommodated in the crevice formed in the undersurface side, and it is in contact with the positive electrode plate 6 and negative electrode plate 8 to both sides of the electrolyte plate 2, respectively. And each above-mentioned oxidizer gas channel 7 is opened for free passage on said oxidant gas way 4 established in the right and left of the layered product via the interconnecting catwalk 10, and the fuel gas way 5 is open for free passage via the interconnecting catwalk which the fuel gas channel 9 does not illustrate.

[0006]While carrying out a deer and supplying oxidant gas to each oxidizer gas channel 7 via the interconnecting catwalk 10 from the oxidant gas way 4, by supplying fuel gas to each fuel gas channel 9 from the fuel gas way 5, fuel gas reacts to oxidant gas in each unit cell, and electromotive force is acquired.

[0007]However, if the manufacturing accuracy of the unit cell which consists of the right and negative electrode plates 6 and 8 laminated by both sides of the electrolyte plate 2 in such a thing, and the separator 1 is not high, The depth of the crevice for each electrode accommodation may be too smaller than the size of the laminating direction of a corresponding electrode plate and a gas channel, or may be too large. Therefore, when the depth of the above-mentioned crevice is too smaller than a specified dimension, only the electrolysis boards 6 and 8 contact the electrolyte plate 2, sufficient pressure for the contact surface of the surrounding separator and the electrolyte plate 2 does not arise, and there are problems -- sufficient wet seal effect is not acquired.

[0008]Then, frame shape edge boards are allocated in up-and-down both sides of a separator board for the separator 1, respectively, and what was considered as the separator and the composition which infixed the spring between edge boards is proposed. Namely, drawing 12 is a sectional view of the fuel cell layered product which constituted the above-mentioned separator 1 by a separator board and edge boards, The 1st edge boards 12 and the 2nd 13 are allocated in the upper surface [of the separator board 11 which separates a unit cell], and undersurface side with the prescribed interval, respectively, and the separator board 11 and the 1st and 2nd edge boards 12 and 13 are mutually joined by welding an edge part.

[0009]The positive electrode receiving opening for accommodating the positive electrode plate 6 in the center section is formed in the 1st edge boards 12 of the above, and the negative electrode receiving opening for accommodating the negative electrode plate 8 is similarly formed in the center section of the 2nd edge boards 13.While carrying out a deer, fitting the layered product of the oxidizer gas channel 7 and the positive electrode plate 6 into the positive electrode receiving opening of the 1st edge boards 12 and laying on the separator board 11, Lay the electrolyte plate 2 on the electrode plate 6 and 1st edge boards 12, and the negative electrode plate 8 and the fuel gas channel 9 are laid on the electrolyte plate 2, You laminate the following separator 1 and the negative electrode receiving opening of the 2nd edge boards 13 of the separator 1 makes it have fitted in on the above-mentioned negative electrode plate 8 and the layered product of the fuel gas channel 9. An electrode plate, an electrolyte plate, etc. carry out plural laminates one by one similarly hereafter, and the fuel cell layered product is formed.

[0010]By the way, the oxidant gas way 4 and the fuel gas way (not shown) are penetrated to the sliding direction in the both ends of a fuel cell layered product as mentioned above, In the portion in which the oxidant gas way 4 is formed, The annular deformable sealing member 14 for oxidant gas is formed so that the above-mentioned oxidant gas way 4 may be surrounded between the separator board 11 and the 2nd edge boards 13, The oxidant gas supplied to the oxidant gas way 4 flows through the oxidizer gas channel 7 through between the separator board 11 in each separator 1, and the 1st edge boards 12, and it is made to have flowed out of the oxidant gas way 4 of another side. Similarly in the portion in which the fuel gas way 5 is formed. The annular deformable sealing member for fuel gas (not shown) is provided between the 1st edge boards 12 of the separator board 11, and the inside of the fuel gas channel 9 is made for the fuel gas supplied to the above-mentioned fuel gas way 5 to have circulated through between the separator board 11 and the 2nd edge boards 13.

[0011]On the other hand, between the separator board 11 and the 1st edge boards 12 and between the separator board 11 and the 2nd edge boards 13, The edge spring 15 is formed in the periphery of the electromotive part which consists of the positive electrode plate 6, the oxidizer gas channel 7, or the negative electrode plate 8 and the fuel gas channel 9, and the manifold spring 16 is formed in the manifold part of the oxidant gas way 4 grade.

[0012][after carrying out a deer and laminating a unit cell], Each edge boards 12 and 13 are resisted and transformed into the edge spring 15 and manifold spring 16 grade by each electrolyte plate 2, The surface of each edge boards 12 and 13 serves as the shape where it learned from the surface of the electrode plates 6 and 8, and each edge boards 12 and 13 are welded by pressure to the electrolyte plate 2 by the above-mentioned edge spring 15 and the manifold spring 16.

[0013]

[Problem(s) to be Solved by the Invention]Thus, in the fuel cell which laminated two or more unit cells which consist of an electrolyte plate, a right and negative electrode plate, etc. Without the oxidant gas and fuel gas which are fed into the above-mentioned right and negative electrode plate part leaking outside, Without mixing ring main, conventionally, with an electrolyte plate and a separator board, supply and to be discharged are required, it is performed by the seal in a reaction part, and in the circumference and the manifold part of an electromotive part. For example, it produces in the contact surface of an electrolyte plate and a separator, the operation by melting carbonate, i.e., the seal by a wet seal, is performed.

[0014]By the way, in what comes and adopts the seal method like ****, In the reaction part, it is required for an electrolyte plate for a crack not to occur, in order to cancel the mismatch on a size between an electromotive part and the edge part of a separator especially, high manufacturing accuracy is required, and we are anxious about aggravation of the yield, increase of a manufacturing cost, etc. In the wet seal part, high manufacturing accuracy is similarly demanded from the performance being influenced by the wettability of carbonate, welding pressure, etc. In further prolonged stability, the loose connection in an electromotive portion arises from the difference with the creep property of electromotive parts, and the creep property of an edge member, therefore internal resistance increases, an output declines, and we are anxious also about

mixing of the ring main in a manifold part.

[0015]In the device shown in drawing 12, in order to cancel the above-mentioned concern, the edge spring and the manifold spring are formed in the edge part and the manifold part, and it is improved individually, respectively. however -- in this thing -- an edge spring and a manifold spring -- a difference of shape -- a basis -- a **** differential shrinkage appears and there is a possibility that excessive bending stress or shearing stress may occur in an electrolyte plate. Since a spring is allocated around a manifold, the allocation and the interval of a ** style element which are not illustrated to the uniform ** style of the distributed gas required of an electromotive part have arrangement work and problems, such as becoming complicated and becoming a high cost by extension, while needing the field of the plane direction of this portion widely.

[0016]This invention reduces the unnecessary bending deformation added to an electrolyte plate in view of such a point, While releasing from a complicated design and manufacturability, a battery characteristic is stabilized over a long time, and by having simple and suitable spring composition depending on the case, it enables it to serve also as a ** style element, and aims at obtaining the fuel cell which can reduce total cost.

[0017]

[Means for Solving the Problem]This invention laminates a negative electrode plate to other fields while laminating a positive electrode plate on the whole surface of an electrolyte plate, In a fuel cell which carried out the plural laminates of the unit cell which allocated a gas channel which forms a gas way respectively in contact with each electrode plate via a separator board, the above-mentioned separator board side and the fuel side -- being certain -- it is -- it being allocated by periphery of an electromotive part by the side of an oxidizer, and, It is between edge boards which carry out field contact with the above-mentioned electrolyte plate, and spring characteristics constituted mutually an edge part and a manifold spring of a circumference of the above-mentioned electromotive part with the same tabular spring substantially.

[0018]

[Embodiment of the Invention]It is drawing of longitudinal section of a fuel cell layered product [in / in drawing 1 / this invention], and a figure showing the plane cross section which shows the state where drawing 2 removed the edge boards 12, and the shape of the oxidant gas way 4 shows the example of the ellipse.

[0019]In drawing 1 and drawing 2, the electromotive part 3 which manages power generation like a conventional example is formed in the center section of the separator board 11, and the oxidant gas way 4 and the fuel gas way 5 are established in both ends as the entrance side of gas, and an outlet side, respectively. The fuel and oxidizer side is separated via the separator board 11. The manifold springs 21a and 21b are allocated for the edge springs 20a and 20b around the electromotive part 3 almost as usual again, the circumference, i.e., the manifold part, of each gas ways 4 and 5. The edge spring 20b currently allocated in a gas road side in this case is considered as the composition which served as the manifold spring.

[0020]By the way, in this invention, the spring characteristics based on the spring shape of the laminating

direction of the edge springs 20a and 20b and the manifold springs 21a and 21b currently allocated at least in the same flat surface by the side of fuel or an oxidizer are substantially made into the same tabular spring. With substantial spring characteristics, the deformation per unit planar pressure, creep property, etc. correspond here.

[0021]Thus, by having made the same the spring characteristics of the portion which the electrolyte plate 2 and the edge boards 12 and 13 contact, and forms a wet seal in the same flat surface, namely, the fuel side -- being certain -- it is -- in the same flat surface by the side of an oxidizer, when constituted by the tabular spring group which has the same spring characteristics, The difference of the planar pressure which becomes almost the same even if the planar pressure added to the portion which the electrolyte plate 2 and the edge boards 12 and 13 contact, and forms a wet seal takes which portion, especially is added to an edge part and a manifold part will decrease sharply. Therefore, the difference of the deformation of edge boards will be reduced by the edge part (an electromotive part is included) and a manifold part, and edge boards become possible [changing with a flat surface maintained]. That is, the unnecessary bending deformation added to an electrolyte plate is reduced, and the stable fuel cell is attained.

[0022]As shown in drawing 1, it can be easy to make spring characteristics the same by using a linear shape thing for all the tabular springs, a design problem can decrease, and it can be considered as a thing ****** also in manufacturing cost.

[0023](a) of drawing 3 and (b) are the top views and sectional views of the tabular spring 22 which constitute the above-mentioned edge springs 20a and 20b and the manifold springs 21a and 21b, Two or more linear projections 23 which project in rectangular directions to the flat surface are mutually formed in the tabular spring 22 in parallel. And the above-mentioned linear projections 23 are formed so that the distance during the adjacent projection may become equal, and as it has the predetermined inclination theta to the length direction of a tabular spring. When the above-mentioned inclination theta leads gas to an electromotive part from each gas ways 4 and 5, it is made into the most desirable angle among ******, and this example shows the example which laminated the spring of two sheets.

[0024]It is possible to make the spring characteristics of a laminating direction the same in most of fields, i.e., the field which incline and is defined by theta, by carrying out a deer and making equal distance between the linear projections which adjoin each other in this example. And since the above-mentioned inclination theta is considered as the most desirable inclination among gas ** styles, By allocating the edge spring 20b of a gas road side, as shown in drawing 4, It can serve as the ** style element at the time of leading gas to an electromotive part from the oxidant gas way 4 and the fuel gas way 5, the conventional ** style element can become unnecessary, the space currently installed can be omitted, and miniaturization of a separator can be attained.

[0025]Drawing 5 is a figure showing the example for making still more uniform modification of the electrolyte plate in a manifold region, In the opening drilled in the edge boards 12 and 13 by the oxidant gas way 4 or the fuel gas way 5, and the corresponding portion, the common-law marriage of the opening is crooked in the separator board 11 side, and the gap between its edge boards 12, or 13 and the separator board 11 is

sealed in the bending piece part.

[0026]That is, on the oxidant gas way 4, the bending piece 13a crooked in the separator board 11 side is formed in the open end edge of the 2nd edge boards 13, and the tip part is welded by the separator board 11. A deer is carried out and the free passage between the oxidant gas way 4 and the fuel gas channel 9 is intercepted with the bending piece 13a. It is made similarly to be intercepted in the free passage with the fuel gas way 5 and the oxidizer gas channel 7 with the bending piece formed in the 1st edge boards 12 on five copies of fuel gas ways.

[0027]However, in such a thing, since the fabricating operation of the edge boards has been carried out, the rigidity of the shaping shoulder A will become large compared with a flat-surface part, and a bend will produce the contraction according to the differential shrinkage in the electrolyte plate which it is forced to have become small compared with flat-surface parts other than near the shoulder, and is in contact with edge boards.

[0028]Then, while the oxidant gas and fuel gas side allocates the edge spring 20b and the manifold spring 21a with an interval in this invention only the prescribed distance X from the aforementioned bending piece part, The open end edge of the electrolyte plate is also allocated in the above-mentioned edge spring 20b, the manifold spring 21a, and the mostly corresponding position. Since the size of an electrode is changed, the width dimensions of the spring are made to have differed by the each side by the anode and negative-electrode side here.

[0029]A deer is carried out, the contact with the electrolyte plate near [rigid / high] the molding shoulder is lost, and the bending deformation of an electrolyte plate is reduced. Since the spring and the electrolyte plate are furthermore installed for the oxidant gas and fuel gas side with the interval of X from the gas road end, Two boards, the edge boards 12, or 13 and the separator board 11, will pay contraction, as shown in drawing 6, and an interval can be made into comparatively short length so that clearly from the strength of materials.

[0030]Drawing 7 and drawing 8 are what showed the composition of the still simpler spring, and the punctiform projection 24 of a large number which project in the flat surface and rectangular directions of a spring plate is fabricated with regularity in arrangement. Drawing 7 shows the example in which drawing 8 fabricated the punctiform projection 24 on plane both sides, and fabricated the punctiform projection by turns only in plane one side. Therefore, by providing many punctiform projections in the arrangement with regularity as mentioned above, the broadly same spring characteristics can be acquired in a flat surface, and, moreover, the spring of arbitrary sizes can be manufactured easily.

[0031]Drawing 9 (a) and (b) is a figure showing other modifications of a tabular spring, and instead of the above-mentioned punctiform projection, many holes are processed into the plate 25, it equips so that the spherical member 26 may be projected to both sides of the above-mentioned plate 25 in the hole, and two or more board lamination of this has been carried out. A deer is carried out, in this example, special molding is unnecessary, and the tabular spring which has simple and cheaply various spring characteristics can be formed.

[0032]

[Effect of the Invention]As explained above, since spring characteristics constituted the edge spring and the manifold spring with the same tabular spring substantially mutually, this invention, The difference of the planar pressure which it becomes almost the same even if the planar pressure added to the portion which contacts an electrolyte plate and edge boards and forms a wet seal takes which portion, especially is added to an edge part and a manifold part will decrease sharply. Therefore, the difference of the deformation of edge boards is reduced by the edge part and a manifold part, edge boards become possible [changing with a flat surface maintained], and the unnecessary bending deformation added to an electrolyte plate is reduced.

[0033]The spring characteristics of a laminating direction can be easily made the same by making equal mutually distance of the projection which the linear projections of a tabular spring adjoin. And it can serve also as the ** style element at the time of leading gas to an electromotive part from a gas way by making inclination of linear projections into a predetermined angle. Therefore, the conventional ** style element becomes unnecessary, can exclude the installing space, and does the effect of being able to attain miniaturization of a separator so.

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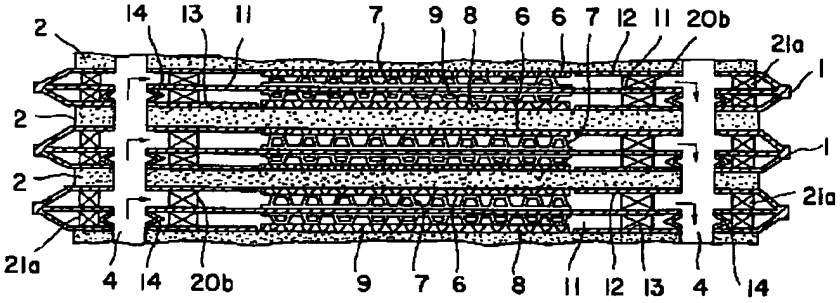
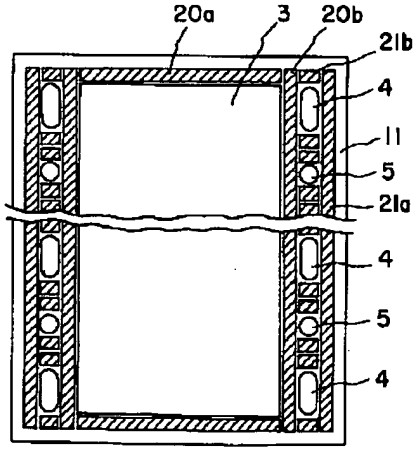
DRAWINGS

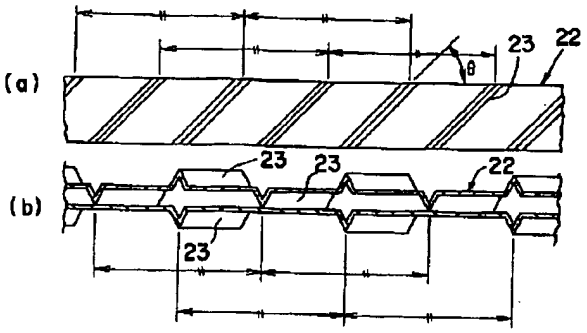
[Drawing 1]



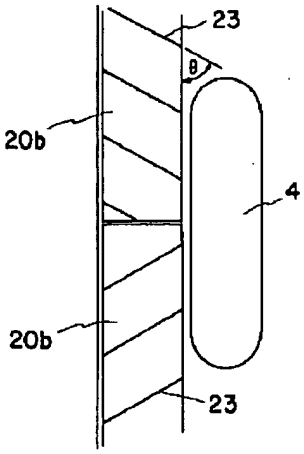
[Drawing 2]



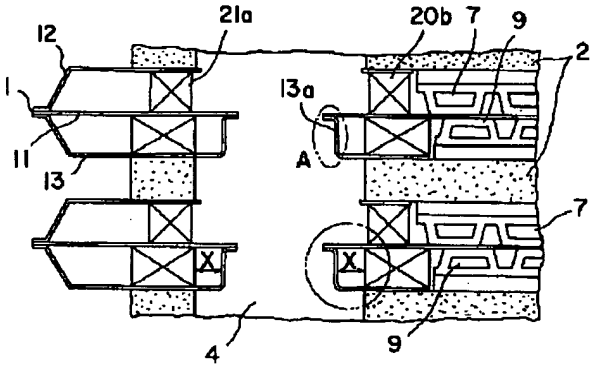
[Drawing 3]



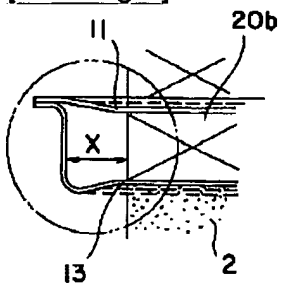
[Drawing 4]



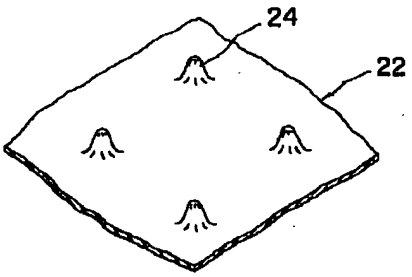
[Drawing 5]



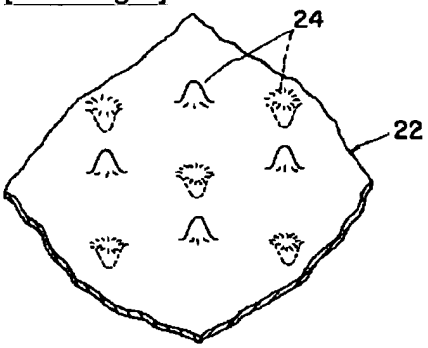
[Drawing 6]



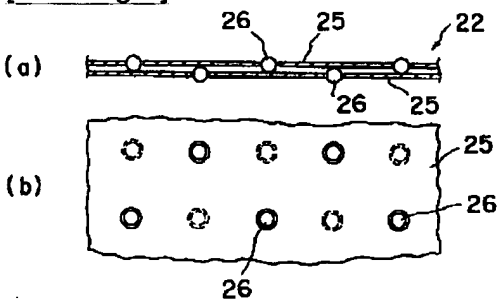
[Drawing 7]



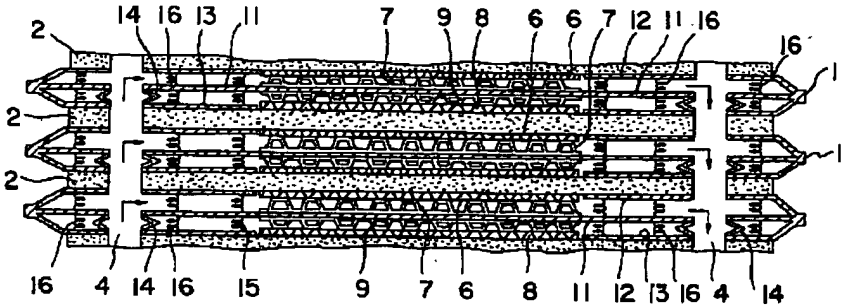
[Drawing 8]



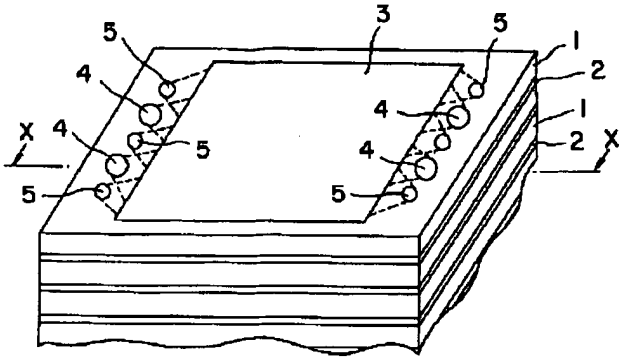
[Drawing 9]



[Drawing 12]



[Drawing 10]



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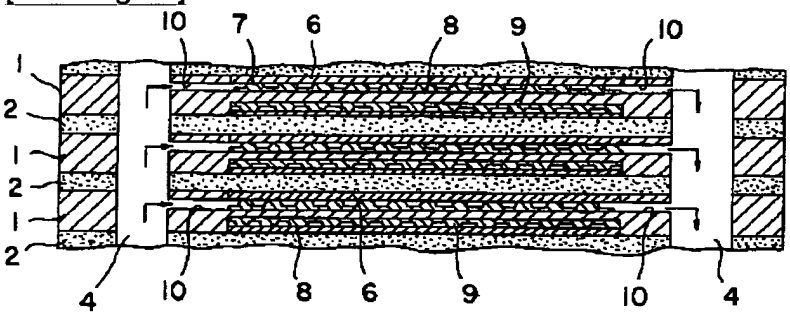

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